



# Macroeconomic Impacts of the Florida Department of Transportation Work Program



*Prepared for  
Florida Department of Transportation*

*Prepared by  
Cambridge Systematics, Inc.*

*In association with  
Glaze Associates, Inc.*

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# Executive Summary

The Florida Department of Transportation (FDOT) has estimated the macroeconomic impacts of its Work Program for fiscal years 2002/2003 through 2006/2007, consistent with Sections 334.046 and 339.137, Florida Statutes – see Appendix A. The Work Program represents an investment of \$26.2 billion in Florida’s multimodal transportation system (in 2002 dollars). Given the data and economic analysis tools available, it was possible to estimate the economic impacts of the majority of Work Program investments using the same economic model that the Florida Legislature uses. The results of the analysis show a very strong connection between transportation investments and key macroeconomic benefits including income for Florida residents, employment, and the value of goods and services produced in the State. Key findings include:

- Work Program investments in highways, transit, and rail over the next five years result in an increase of \$44 billion in personal income for Florida residents and generate 88,000 new permanent jobs over the next 25 years.
- Work Program investments also yield significant direct user economic benefits to personal travel in terms of reduced travel time, vehicle operating costs, and accident costs. The direct benefits for personal travel over the 25-year analysis period are estimated to be \$74 billion.
- Macroeconomic business benefits and personal travel benefits yield \$5.50 worth of economic benefits for every \$1.00 invested in the Work Program for highway, rail and transit in Florida.
- Based on studies conducted in Florida and other states, it is clear that the state’s airports and seaports are critical to maintaining an effective multimodal transportation system and support very significant levels of economic activity. Available studies indicate that investments that increase the capacity or service at airports and seaports also can return benefits in the range of \$2 to \$13 for every dollar invested. Analysis tools to directly calculate benefits of Work Program investments in seaports and aviation, consistent with the approach used for other modes, were not available.

In summary, investments in Florida’s transportation system yield significant benefits to both business and personal travel. As the State continues to grow, it is likely that transportation investments will yield even more significant returns in the future and will remain a vital factor to maintain and strengthen the state’s economic competitiveness. While the focus of this study was on the FDOT Work Program, it is recognized that the Work Program does not represent the total investment being made in Florida’s transportation system by all levels of government and the private sector.

# 1.0 Introduction

Every day, Florida's transportation system moves workers to their jobs, raw materials and supplies to factories, finished goods to store shelves, farm products to markets, visitors to tourist destinations, and consumers to retail establishments. The state's economic health and its ability to remain competitive with other regions of the country depend on the efficient transport of people and goods.

Florida's multimodal network of roads and highways, commercial and general aviation airports, seaports, passenger and freight railroads, and public transportation services has evolved over time as a result of continuous investment. Today, and in the future, the improvement and expansion of this system depends on public expenditures on new and improved infrastructure, technology, and services. These investments have both direct benefits, including travel time savings for commuters and reduced shipping costs for manufacturers, and broader economic impacts.

The objective of this study is to estimate the macroeconomic impacts of the Florida Department of Transportation's (FDOT) five-year Work Program (2002/2003 through 2006/2007). This macroeconomic analysis establishes the link between Work Program investment in highways, transit, and rail over the next five years, and economic growth in Florida over the next 25 years.

The remainder of this report is organized into four sections. Section 2.0 provides project background for this study, including a description of the Florida legislative mandate that was the impetus for this study and development of the macroeconomic analysis tool. In addition, it reviews the components of the Department's Program and Resource Plan that are analyzed by the macroeconomic analysis tool. Section 3.0 discusses the analytical models and the methodology used to develop this analysis tool and generate macroeconomic impacts.

Section 4.0, "Macroeconomic Impact Results" presents the results of the quantitative analysis conducted for the study. The macroeconomic benefits of the FDOT Work Program are estimated using advanced modeling techniques that combine monetary values for user benefits (e.g., time savings and reductions in operating costs) with a regional economic simulation model to predict macroeconomic impacts (e.g., employment, personal income, and gross state product).

Finally, Section 5.0, "Economic Benefit/Cost Analysis" reviews the framework used to conduct an economic benefit/cost analysis of the five-year Work Program, and presents results of that analysis.

## 2.0 Project Background

### ■ 2.1 Response to Legislative Mandate

The catalyst for this study is a Florida legislative requirement, passed in 2000, to analyze the macroeconomic implications of transportation investments and to provide an understanding about how transportation impacts the state's competitive position. A more thorough listing of the relevant legislative mandate(s) can be found in Sections 334.046(4)(b) and 339.137(2)(b), Florida Statutes (Appendix A). In addition, the 2020 Florida Transportation Plan (FTP) includes enhanced economic competitiveness as one of four long-range goals for the state.

The key objective of the legislative requirement is to ensure “that the state has a clear understanding of the economic consequences of transportation investments...[and to] develop a macroeconomic analysis of the linkages between transportation investment and economic performance” at the state and district levels. The macroeconomic analysis model is targeted at increasing the understanding of the linkage between transportation investments and economic performance. In response to this legislative mandate, FDOT has developed a macroeconomic analysis methodology to evaluate the long-term economic benefits of FDOT's Work Program. These benefits include increases in personal income to Florida's residents, employment, and gross state product (i.e., the total value of goods and services produced).

The legislation specifically requires the analysis to assess the following “1) The state's and district's economic performance relative to the competition; 2) The business environment as viewed from the perspective of companies evaluating the state as a place to do business; and 3) The state's capacity to sustain long-term growth.”

1. **The state's and district's economic performance relative to the competition.** Investments in transportation can improve travel time, reduce vehicle-operating costs, and lessen economic costs associated with accidents. The macroeconomic model developed by FDOT directly analyzes the impact of Work Program investments on travel conditions in the state. The model quantifies the benefit of Work Program investments that reduce transportation costs, and then translates those benefits into cost savings for the state's businesses. The reduced cost of doing business in Florida allows businesses to be more competitive and increase market share. Specific business benefits are increased output (sales), more spending on research and development, hiring additional workers, and ultimately increasing the personal income of Florida's residents. Building and maintaining a strong, efficient, and reliable multimodal transportation system will help ensure that Florida's economy continues to grow, remains competitive, and allows businesses to market their products worldwide at competitive prices. Finally, these economic impact results are estimated at the state and district levels.

2. **The business environment as viewed from the perspective of companies evaluating the state as a place to do business.** The Regional Economic Models, Inc. (REMI) economic simulation model, used in the macroeconomic analysis, accounts for the expansion and attraction of firms due to a reduced cost of doing business from transportation investments. REMI estimates business expansions and attractions, as well as an influx of workers who would move to the state to take advantage of new employment opportunities and the improved business environment. Over a 25-year period, the improved business environment would help create an estimated 88,000 new permanent jobs.

In addition, previous work by the Florida Chamber Foundation, the *Transportation Cornerstone* study, provides a detailed evaluation of the business environment and transportation service in Florida. That study included many interviews with businesses in Florida to understand their transportation needs and recommended policies and investments to address those needs. The macroeconomic analysis did not attempt to replicate the work done in this report.

Finally, the Strategic Intermodal System (SIS) Economic Competitiveness Drafting Group evaluated, and identified key multimodal facilities throughout Florida. These facilities (including ports, airports, and highways) were deemed vital to Florida's business environment, and recognized as drivers of future economic growth.

3. **The State's Capacity to Sustain Long-Term Growth.** The emphasis of this analysis was on the long-term economic growth impacts of transportation improvements rather than short-term, temporary benefits. The macroeconomic model evaluates Work Program investments over a 25-year period. The REMI economic model estimated the full economic impact of the reduced cost of doing business in Florida resulting from Work Program investments that reduce transportation costs over time in a dynamic fashion as changes to the economy affect prices, wages, and other competitiveness factors. Over a 25-year period, Work Program investments will reduce the cost of doing business in the state, and is estimated to result in an increase in personal income for Florida residents of \$44 billion and generate 88,000 new permanent jobs. Also over this 25-year period, every \$1.00 invested through the Work Program generates \$5.50 in benefits for Florida's residents and businesses. It is important to note that these results reflect the benefit of the five-year Work Program versus no investment in highways, transit, or rail over the five-year period. In other words, these results represent the benefit of investing \$15.2 billion in highways, rail, and transit in the course of five years, versus doing nothing.

While the focus of this study was on the FDOT Work Program, it is recognized that the Work Program does not represent the total investment being made in Florida's transportation system by all levels of government and the private sector.

## ■ 2.2 Florida Department of Transportation Work Program

Consistent with the legislative mandate, the focus of the macroeconomic analysis is to assess the impacts of the transportation investments in the FDOT Work Program. Investments

include activities such as new road construction, capital expenditures, resurfacing, right-of-way purchases, etc. These activities are found in the “Product” category within the Program and Resource Plan (PRP), which includes a summary of Work Program investments over the next five years. Expected expenditures over the next five years within this category are the primary emphasis of the macroeconomic analysis.

In addition to Product expenditures, the Department’s PRP includes categories for other activities, including Product Support, Operations and Maintenance, and Administration. These support activities are essential and the Product expenditures could not occur without them. Consequently, support activities related to Product spending (\$9 billion in 2002 dollars) were estimated and included as part of the cost of delivering the Work Program investments.

### *Product Investments within the Work Program*

Table 2.1 presents the proposed expenditures by Product and other investment categories contained in the 2002/2003 to 2006/2007 Work Program in 2002 dollars.<sup>1</sup> As Table 2.1 shows, over 80 percent of the Work Program Product investments are focused on highway capacity, preservation, and safety (primarily highway-related) investments.<sup>2</sup> However, significant investments are also made in a variety of other modes.

Given the data and economic analysis tools available, the macroeconomic impacts of highway, bridge, transit, rail, and safety investments were estimated directly using transportation impact models (e.g., HERS) and a macroeconomic simulation model (REMI model) that is also used by the Florida Legislature. The economic impacts from aviation and seaport investments were estimated separately based on other studies done in Florida and elsewhere. Tools and data to assess the incremental benefits from new investments in seaport and aviation modes were not available to generate results consistent with the analysis done for highway, rail, and transit. See Section 3.1 for more detail on this topic.

The Transportation Outreach Program (TOP) is a relatively small component (2.8 percent) of the Product category. It is targeted for economic development projects and may be applied to any mode. Since it is not mode-specific and individual TOP projects are chosen for only one year of the Work Program at a time, it was not possible to assess this program.

The relevant support costs associated with the Product investments shown in Table 2.1 were allocated to each Product category based on the category’s share of the total Work Program investments. Within the context of this analysis, we analyze Product Support, Operations and Maintenance, and Administration expenditures totaling \$9 billion, and together with Product investments (\$17.2 billion) add up to \$26.2 billion in total expenditures (in 2002 dollars).

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<sup>1</sup> Some of Right of Way may be related to rail or transit, but this portion is typically so small that it is included in Highway. In future analyses, it may be necessary to distribute these investments to other modes.

<sup>2</sup> Most Bridge investments are related to preservation rather than adding new capacity and for this analysis, all bridge investments were considered to be preservation. If there had been any specific major bridge projects that would add new capacity, they would have been modeled as new capacity impacts.

**Table 2.1 FDOT Work Program Investments**  
(in millions of 2002 dollars)

Total 2002/2003 to 2006/2007		
Product	Percent of Total Product	
<b>Highway</b>		
A. Intrastate Highways	4,566	26.6%
B. Other Arterials	2,654	15.5%
C. Right-of-way	2,656	15.3%
<b>Highway Capacity</b>	<b>9,876</b>	<b>57.4%</b>
J. Resurfacing	2,838	16.6%
K. Bridge	966	5.6%
<b>Highway Preservation</b>	<b>3,804</b>	<b>22.2%</b>
<b>Total (Highway)</b>	<b>13,680</b>	<b>79.6%</b>
<b>Public Transportation Capacity</b>		
D. Aviation	493	2.9%
E. Transit	769	4.5%
F. Rail	423	2.5%
G. Intermodal Access	902	5.1%
H. Seaports	165	1.0%
<b>Total (Public Transportation Capacity)</b>	<b>2,752</b>	<b>16.0%</b>
I. Safety	274	1.6%
L. Transportation Outreach Program	468	2.8%
<b>Total (Product)</b>	<b>17,174</b>	<b>100.0%</b>
<b>Other</b>		
Product Support	5,119	
Operations and Maintenance	3,300	
Administration	558	
<b>Total (Other)</b>	<b>8,977</b>	
<b>TOTAL</b>	<b>26,150</b>	

Source: Florida Department of Transportation 2002 Work Program Summary, 2002/2003 through 2006/2007.

### *Defining Work Program Expenditures*

There are three ways to define Work Program expenditures: Year of Commitment Dollars, 2002 Dollars, and Discounted Costs. The expenditure concept used depends on the specific analysis. *Since the quantitative estimation of economic impacts focused on highways,*

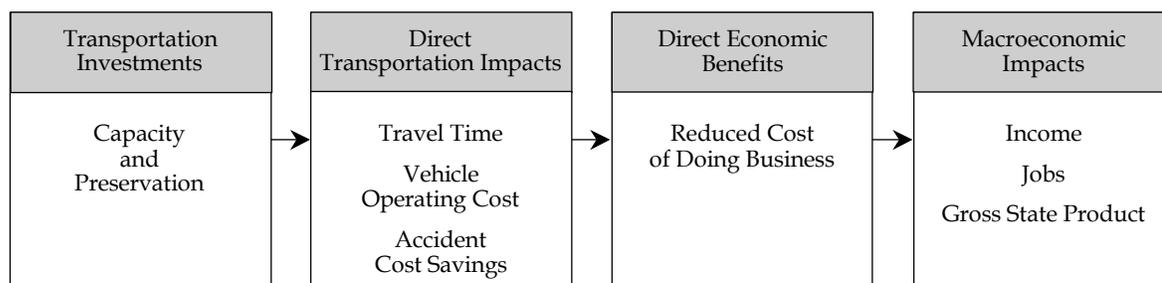
rail and transit investments, the following definitions (and the remainder of the report) cover only the expenditures specific to those modes. Within the framework of this analysis, Work Program expenditures are analyzed using the following definitions:

- **Year of Commitment Dollars.** Year of commitment dollars (sometimes called nominal dollars) reflect the actual Work Program investments that are expected to occur in future years, accounting for future inflation. This is consistent with how FDOT presents investments in its Work Program summary documents, and is described here for comparison and reference purposes only. Within the context of this analysis, we analyze Work Program Product investment totaling \$16 billion in year of commitment dollars. Work Program Product Support, Operations and Maintenance, and Administration expenditures are \$9.5 billion – combined with Product investments the total Work Program equals \$25.5 billion. This report, however, presents expenditures only as 2002 dollars and discounted costs (2002 dollars).
- **2002 Dollars.** Work Program investments in year of commitment dollars are adjusted to reflect 2002 dollars. This enables an analysis of investments (costs) and benefits over different time frames by removing the impact of inflation. In 2002 dollars, Work Program Product investments are \$15.2 billion. Work Program Product Support, Operations and Maintenance, and Administration expenditures total \$8.9 billion – combined with Product investments total \$24 billion.
- **Discounted Costs.** In order to provide a consistent basis for a comparison of dollar concepts over time, the value of future Work Program investments and benefits are discounted to reflect a present value at 2002 levels. Essentially, discounting Work Program expenditures accounts for the time value of money as a dollar today is worth more than a dollar next year since it can be invested and earn interest (above inflation). Discounted Work Program expenditures and benefits are utilized in the benefit/cost analysis section of this report. Using a discount rate of 7 percent, the discounted present value of Work Program Product expenditures is \$13.6 billion, and Work Program Product Support, Operations and Maintenance, and Administration is \$7.9 billion – totaling \$21.5 billion.

## 3.0 Study Approach and Methodology

This section describes the analytical methodology used to estimate the macroeconomic impacts of Work Program investments. The general analytical framework is shown in Figure 3.1. Investments in transportation have a direct impact on travel time, vehicle operating cost and accident costs. These cost savings represent direct economic benefits to both personal travel and business-related travel including freight. For the business-related portion of these benefits, the resulting reduction in the cost of doing business leads to macroeconomic benefits measured by increases in personal income for Florida residents, employment, and gross state product. Estimating these macroeconomic impacts is the focus of this study.

**Figure 3.1 Macroeconomic Analysis Framework**

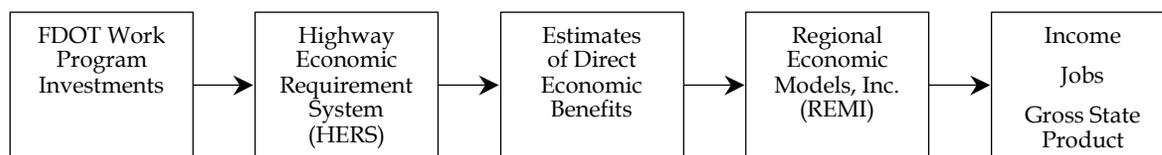


It is worth noting that the emphasis of the direct transportation impact analysis for each mode was on business traveler and logistics/reliability benefits. Additional business attraction impacts (e.g., industrial relocation due to a new highway) are the most inherently speculative component of any transportation/economic development analysis and usually require project-specific study, and therefore are not assessed in this analysis.

Figure 3.2 illustrates how two available analytic tools were used to estimate the macroeconomic impacts of the Work Program investments in highways, transit, and rail. A brief description of these tools is provided below.

**Highway Economic Requirements System (HERS) Model.** The HERS model estimates the highway user benefits from investment programs that affect either highway system performance or usage. The model has been used in a number of states, and at the national level, to estimate the direct economic benefits of highway investments. The U.S. General Accounting Office has evaluated the HERS model approach and found it an appropriate tool to estimate highway program investments at both the federal and state level.

**Figure 3.2 Macroeconomic Analysis Tools**



The HERS model estimates three types of direct highway user benefits, which can be quantified in monetary terms.

1. **Travel Time Savings.** Travel time savings reflect the dollar value of the reduction in vehicle-hours of travel that is associated with improved highway conditions. Travel time savings result from reduced congestion due to increased highway capacity or reduced vehicle miles of travel (i.e., from diversion to transit and rail), improved roadway geometry, and improved pavement condition. The model assigns different values of time for personal auto, business auto, and truck trips. Reduced inventory holding costs and the benefits from reductions in non-recurring incident delay are also captured in the travel time benefits.
2. **Vehicle Operating Cost Changes.** Vehicle operating costs include fuel, tires, lubricants, and maintenance. These costs are affected both by travel time and the general wear and tear on vehicles from substandard pavement conditions.
3. **Safety Effects.** Investments can reduce the crash rate on a highway system by reducing congestion and improving roadway geometry. Conversely, improving highway conditions could increase the number of accidents by inducing more total travel on the highway network or increase accident severity if speeds increase significantly.

**Regional Economic Models, Inc. (REMI).** The REMI model is a regional economic simulation model that can be used to estimate the macroeconomic impacts of policies or investments that change some aspect of the business climate in the region. The REMI model used in this study is a statewide model, with 53 industry-sector detail – the same model used by the Florida Legislature. REMI generates control forecasts and simulates policy changes based on a series of linked socioeconomic variables representing industry output, demand for goods and services, labor supply, wages and prices, and industry market shares. It is the most widely used and accepted economic impact tool in the country, with unique capabilities for transportation analyses. For this study, the estimates of direct business travel benefits (business auto and truck) generated by the HERS model were translated into reductions in the cost of doing business and input into REMI to estimate macroeconomic impacts.

## Transportation Modes

The impacts of highways, rail, and transit are assessed using a similar methodology and similar analytical tools (i.e., HERS and REMI). However, because of the lack of readily available data and the lack of an analogous HERS tool for seaports and aviation, those impacts are measured based on existing studies in Florida and the rest of the country.

### *Highways*

The impacts of highway investments are measured through a combination of the HERS and the REMI models. FDOT highway investments over the next five years are inputs to HERS, which is a program-level highway benefit analysis model. HERS estimates program-level benefits of highway investments split between capacity and preservation expenditures, consistent with the Work Program. Monetary benefits include travel time savings, operating costs, and reduced accident costs. In addition, HERS estimates inventory holding costs and the benefits from reductions in non-recurring incident delay (i.e., logistics and reliability), which are captured in the travel time benefits.

HERS is typically run using the Highway Performance Monitoring System (HPMS) sample data on a small portion of a state's highway system. However, for this project, the study team has worked with the FDOT Transportation Statistics Office to develop estimates and apply default factors to enhance the non-sample portion of the Roadway Characteristics Inventory (RCI) database for use in HERS. Using this enhanced extract of the data provided by the RCI increases the portion of State Highway System miles covered from 14 percent to 100 percent.

The business travel component of the benefits estimated by HERS (trucks and business auto) is used as an input to the REMI model, as a reduction in the cost of doing business. Costs are input to REMI by industry based on their use of trucking and their share of economic activity. The REMI model generates statewide macroeconomic impacts (employment, income, business output, etc.) based on the improved industry competitiveness due to these cost reductions. Impacts are estimated at the state level and then allocated to districts based on the origin-destination (O-D) patterns of highway trips and the distribution of economic activity throughout the State. The allocation of benefits based on O-D patterns (50 percent to the origin, 50 percent to the destination) is standard practice in transportation economics and is an attempt to allocate benefits to the true beneficiaries of more efficient travel (shippers and receivers, etc.), rather than simply the location of the highway improvement.

**Bridges.** The HERS model and HPMS highway data do not include information regarding bridges. So, a model similar to HERS is used for bridges to capture the benefits of bridge investments – the National Bridge Investment Analysis System (NBIAS). This system contains Florida-specific bridge data and allocates investments from the Work Program to Florida bridges to generate program-level benefits. Similar to the highway analysis, NBIAS benefits are then used as inputs to REMI to generate macroeconomic impacts.

### *Transit*

**Macroeconomic Impacts.** The macroeconomic impacts of transit are best captured by assessing the extent to which increases in transit investment, service, and ridership reduce

highway congestion in the business travel and freight sectors. Travel times and operating costs for business travel (trucks and business auto) are reduced when trips are made on transit that would otherwise be made in automobiles. Therefore, projections of transit ridership due to increased investment and service (also accounting for expected population growth), are used to directly reduce vehicle miles of travel (VMT) in the HERS analysis (see Table 3.1). For example, transit ridership is expected to increase from 208.5 million in fiscal year 2002/03 to 223.8 million in fiscal year 2006/07 – leading to an annual reduction in VMT of 32.7 million fewer miles traveled in FY 2006/07. Reductions in VMT are allocated to Florida highway segments based on the current distribution of transit ridership in the State. This results in user benefits that are input to the REMI model as cost savings. The analysis is careful to only capture the impact due to the Work Program, which includes federal and state investments for capital and operations, but does not include other local, private, or federal expenditures that are not included in the Work Program.<sup>3</sup> The Work Program share of total transit capital investments from all sources over the past three years has averaged just under 40 percent.

**Table 3.1 FDOT Work Program Transit Investment and Annual Reduction in VMT**  
*Transit Investment, Service, and Ridership (in millions, dollars in 2002\$)*

Fiscal Year	Investment	Revenue Miles of Service	Transit Ridership	Estimated Annual Reduction in VMT
1984/1985	\$26.1	64.1	141.3	
1989/1990	\$49.4	84.6	151.5	
1994/1995	\$115.7	118.8	172.4	
1999/2000	\$129.5	138.8	195.7	
2000/2001	\$136.2	147.3	199.6	
2001/2002	\$139.3	158.1	204.5	
2002/2003	\$180.6	166.7	208.5	6.7
2003/2004	\$145.6	175.6	212.5	13.6
2004/2005	\$151.9	184.1	216.4	20.2
2005/2006	\$146.8	192.4	220.2	26.6
2006/2007	\$143.8	200.3	223.8	32.7

Source: Florida Transit Information System, Florida DOT, and Cambridge Systematics, Inc.

**Social Benefits.** In addition to macroeconomic impacts that directly affect the productivity and profitability of business activity, transit investments also result in significant societal benefits. These take the form of increased access to jobs, health care, and other

<sup>3</sup> Some Federal funds for mass transit are distributed directly to local transit agencies rather than through the FDOT Work Program.

services. In addition, fixed-route transit service also benefits the “transit disadvantaged” since they can pay a fare that is considerably less than other options (such as a taxi). These benefits are not included in our total macroeconomic analysis, but are a very important component of transit benefits. Benefits due to increased access are addressed in the Transit Cooperative Research Program’s (TCRP) Report #34, “Assessment of the Economic Impacts of Rural Public Transportation”,<sup>4</sup> and benefits to the transit disadvantaged are estimated based on a methodology developed by the Center for Urban Transportation Research (CUTR) at the University of South Florida in their study “An Analysis of the Economic Impacts of Urban Transit Systems on Florida’s Economy.”<sup>5</sup>

## **Rail**

**Passenger Rail.** Rail investments represent 2.5 percent of the current five-year Work Program and are one of various funding sources for railroads. Only the FDOT Work Program’s share of rail investments is included in the analysis, which is estimated at about 75 percent of the public capital investment in passenger rail.

Ninety percent of the FDOT rail investments are targeted at passenger service, and consequently are the primary focus of the rail analysis.<sup>6</sup> Passenger rail investments are split between Tri-Rail in southern Florida and a proposed Amtrak investment project known as the East Coast Railway.<sup>7</sup> Similar to transit macroeconomic impacts, the analytical methodology focused on rail ridership projections that were then translated into reduced VMT to run through HERS (see Table 3.2). Business-related user benefits were used as inputs to REMI to generate macroeconomic results.

**Freight Rail.** Though the FDOT freight rail investments are much less than those for passenger rail (since most freight rail investments come from the private sector), economic impacts are estimated. For rail/highway crossings, the benefit is in the form of reduced accidents and accident-related costs. Historical data from FDOT is used to assess the safety benefits of these investments. Impacts of rail rehabilitation investments (typically \$0.6 million per year) are estimated using average benefit/cost findings of previous studies of rail rehabilitation projects. The measured benefits are essentially cost and time savings for freight rail shippers and local industries.

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<sup>4</sup> *Assessment of the Economic Impacts of Rural Public Transportation*, Ecosometrics, Inc. Prepared for the Transportation Research Board, Transit Cooperative Research Program Report 34. National Research Council: Washington, D.C., 1998.

<sup>5</sup> *An Analysis of the Economic Impacts of Urban Transit Systems on Florida’s Economy*, Center for Urban Transportation Research (CUTR). Prepared for the Florida Department of Transportation and the Florida Transit Association. September 1997.

<sup>6</sup> Work Program expenditures for high-speed rail are not included in this analysis, since the current spending is focused on engineering and design.

<sup>7</sup> The Amtrak/East Coast Railway Project will include the implementation of extensive track and signal improvements on the East Coast Rail line, and building new passenger rail stations in eight communities along the East Coast.

**Table 3.2 Rail Ridership and Annual Reduction in VMT Projections**  
(in thousands)

	Amtrak Ridership	Annual Reduction in VMT	Tri-Rail Ridership	Annual Reduction in VMT
2003			2,635	966
2004			3,011	4,939
2005	195	14,727	3,162	6,535
2006	225	16,955	4,110	16,553
2007	254	19,183	4,316	18,729

Source: Tri-County Commuter Rail Authority and Amtrak.

**Signal Safety Improvement Program (SSIP).** The SSIP provides improvements to railroad-warning devices. Improvements to warning devices have been shown to help reduce the risk of fatal and severe accidents at railroad/highway crossings. This program is expected to receive an average of \$4.6 million per year (in \$2002 dollars) in funding on an annual basis over the next seven years through the Rail and Highway Crossings section of the Work Program. While it is difficult to actually quantify the economic impact of this program, a portion of its success is measured through the gradual reduction in fatal accidents (20 to 11) and injuries (49 to 33) from 1995 to 2001.

### *Aviation*

Aviation investments represent 2.9 percent of the Work Program investments. FDOT is one of various sources of funding for the aviation industry. State funds may be used for a variety of projects, from runways and taxiways to security, weather observation stations, and various other types of needs.

Commercial airports clearly play a critical role in business activity and tourism, as well as facilitating future economic growth throughout the State. Unlike highways, rail, and transit, the analytical tools and data to support the estimation of program-level aviation investments are not currently available. Instead, this study examines existing studies that assess the economic contribution of aviation activity. As part of the Florida Aviation System Plan (FASP) 2000, an economic impact study of Florida's aviation system (commercial airports and public-use general aviation, and military aviation facilities) was prepared.<sup>8</sup> This FASP study sought to analyze the annual economic impact of Florida's aviation system on the regional economy, and identifies significant economic benefits for the State (reported in Section 4.0). However, there are two key differences between this approach and the macroeconomic analysis approach that render the results impossible to directly incorporate.

<sup>8</sup> *Technical Summary for the Florida Airports Economic Impact Study*. FASP 2000. Prepared by Wilbur Smith Associates, Inc. August 2000.

First, the FASP study is focused on the impacts of the entire aviation system as it exists today, rather than a study of the impacts of incremental future investments to improve the existing system (i.e., the FDOT Work Program). Second, the estimated impacts largely relate to operational spending (e.g., payroll, airport purchases) at the airports, but do not reflect efficiencies and benefits gained through improved air service (the focus of the macroeconomic study). In other words, existing studies focus on the economic contribution of spending, rather than long-term transportation system efficiencies. Several studies that examine the economic impact of airport-specific (not program-level investment) expansion and improved service investments are referenced in the benefit/cost analysis section (Section 5.0) of this report.

### **Seaports**

Seaport investments represent one percent of the Work Program investments. State funds may be used for a variety of projects including dredging and deepening channels, cranes, security, environmental projects and a variety of other projects. The deepwater seaport system is a critical component of the transportation network in Florida and a principal driver of economic growth. Unlike highways, rail, and transit, the analytical tools and data to support the estimation of program-level seaport investments are not currently available. Instead, this study examines existing studies that assess the economic contribution of seaport activity.

A recent study for the Florida Ports Financing Commission (FPFC) examined the economic and fiscal impact of Florida's seaports including the impact on jobs, business sales, and earnings within the State.<sup>9</sup> Economic impact results from that study are shown in Section 4.0. Similar to the aviation studies, the FPFC study examines the contribution of existing ports to the regional economy, as opposed to the incremental benefits of port investments that improve port capacity or service. Spending for ongoing port operations and port construction, while an important benefit, is a measure of the economic contribution of spending, rather than a measure of the macroeconomic benefits of port improvement projects. Because of these differences, it was not possible to directly incorporate these results in the macroeconomic analysis. Several studies that examine the economic impact of seaport-specific expansion projects are referenced in the benefit/cost analysis section of this report (Section 5.0).

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<sup>9</sup> *An Analysis of the Economic and Fiscal Impact of Florida's Seaports*, Florida Ports Financing Commission, prepared by MGT of America, Inc. February 1999.

## 4.0 Macroeconomic Impact Results

Transportation investments create both tangible and intangible economic benefits. Benefits, such as reduced travel times and vehicle operating costs, accrue directly to individuals using the transportation system, and to businesses experiencing increased productivity and demand for their goods and services.

**Direct Highway User Benefits.** This section presents the direct user economic benefits of highway capacity, highway preservation, bridge, transit, and rail Work Program investments. Table 4.1 summarizes the Work Program Investments in each of these areas. The direct highway user benefits resulting from FDOT Work Program investments from 2002/2003 through 2006/2007 are summarized in Table 4.2. It is important to note that these results reflect the benefit of the five-year Work Program versus no investment in highways, transit, or rail over the same time period. In other words, these results represent the benefit of investing \$15.2 billion in highways, rail, and transit in the course of five years, versus doing nothing.

As expected, impacts grow rapidly over the first five years as Work Program investments are made and they continue to grow over time since the benefits are compared against a base case scenario reflecting no Work Program investments. The largest component of these direct user benefits is related to travel time savings. Table 4.2 also shows the portion of these total user benefits (personal and business travel) that are business-related. Business travel (trucks and auto) composes approximately 20 percent of total highway user benefits. These business benefits are used as inputs to the REMI economic simulation model.

**Table 4.1 FDOT Work Program Investments (Product)**  
(in millions of 2002\$)

Fiscal Year	Highway and Bridge	Rail	Transit	Total Work Program
2002/03	4,325	143	181	4,649
2003/04	3,007	51	146	3,203
2004/05	2,532	54	152	2,738
2005/06	1,961	85	147	2,193
2006/07	2,154	90	144	2,387
Total	13,979	423	770	15,170

Source: Florida Department of Transportation.

**Table 4.2 Direct Highway User Benefits over Time**  
(in millions of 2002\$)

	Total Direct Highway User Benefits	Economic Benefit	
		Business Auto	Truck
2003	2,053	218	224
2006	6,330	681	608
2010	8,374	903	790
2015	8,827	953	822
2020	9,474	1,023	879
2025	10,174	1,099	940

Source: Highway Economic Requirements System, Cambridge Systematics, Inc.

**Transit Social Benefits.** As mentioned above, there are many benefits from transit investments that are not readily captured by macroeconomic analysis. However some national studies have attempted to estimate a broader range of benefits. Based on the TCRP 34 report, a multiplier of 3.1 can be used (that is at the low end of the benefit/cost ratios) to estimate the impact of FDOT Work Program transit investments.<sup>10</sup> If this factor is applied, the Work Program will, over the next five years, generate roughly \$400 million in annual social benefits (access to jobs, health care, shopping, etc.). In addition, an analysis of the transit disadvantaged and ridership projections produce benefits of about \$15 million over the next five years. These benefits were due to reduced fare costs of fixed route trips versus other travel options (i.e., taxi, vans, etc.).

## Macroeconomic Impacts

### *Highway, Rail, and Transit*

The economic impact of capital investment on highways, transit, and rail extends beyond direct user benefits. Existing businesses in the State will experience a reduction in production costs associated with the direct highway user benefits. This reduction in costs improves the competitive position of the firms, making them better able to expand and increase market share. Furthermore, highway improvements can extend the customer base that businesses can serve and the area from which they can access supplies.

<sup>10</sup>TCRP Report 34, 1998.

The direct user benefits that accrue to businesses fall into two categories:

1. **Trucking Benefits.** Businesses that use, own, or operate trucks are the major direct beneficiary of these user benefits. These are largely the shippers and receivers of motor freight.
2. **Business Auto Benefits.** Businesses whose employees drive “on-the-clock” for business purposes, such as sales meetings, also experience a direct benefit from reduced travel times and costs.

Business auto and truck travel efficiency and cost savings impacts by industry are used as direct inputs to the REMI economic simulation model to estimate macroeconomic impacts for the State. Unlike most static input-output models, the REMI model provides a way to reflect industry cost reductions over a number of years and these impacts increase the competitiveness of a region’s economy over time, leading to greater economic output, employment, and income.

For example, the model captures key interrelationships within the economy such as the increase in competitiveness and production (sales) due to reduced transportation costs. The model is also calibrated by REMI using data specific to the state of Florida. The REMI simulation model is run to develop a forecast of the economy with incremental increases in Work Program investment. Results of the alternative forecast are then compared to a baseline (“no action”) economic forecast for the State to estimate the total economic impact (including the multiplier effect) of direct highway user benefits.<sup>11</sup> The baseline forecast of Florida measures expected growth in gross state product (GSP), personal income, employment, and other measures without any Work Program investment.

Table 4.3 presents the economic impact results for a single year, 2027, for total Work Program investments in highway, rail, and transit.<sup>12</sup> This impact grows over time (as depicted in Figure 4.1 below) and represents the difference between macroeconomic indicators in a zero-investment forecast and Work Program investments.<sup>13</sup> By 2027, business output gains are almost \$9.0 billion, real personal income has increased by \$6.2 billion, and employment gains are over 87,000.

These are clearly large benefits and reflect FDOT expenditures of \$15.2 billion (in real 2002 dollars) versus making zero-investment over the same time period. Industries expected to benefit the most are: retail, construction, business services, restaurants, and professional services. These industries tend to be large ones in the State, and also require trucking services.

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<sup>11</sup>More information can be found through Regional Economic Models, Inc. at [www.remi.com](http://www.remi.com) and *REMI Policy Insight Users Guide, Version 3.1*.

<sup>12</sup>Macroeconomic impacts are reported for 2027 to be consistent with the timeline of the benefit/cost analysis (from 2003 to 2027 or 25 years).

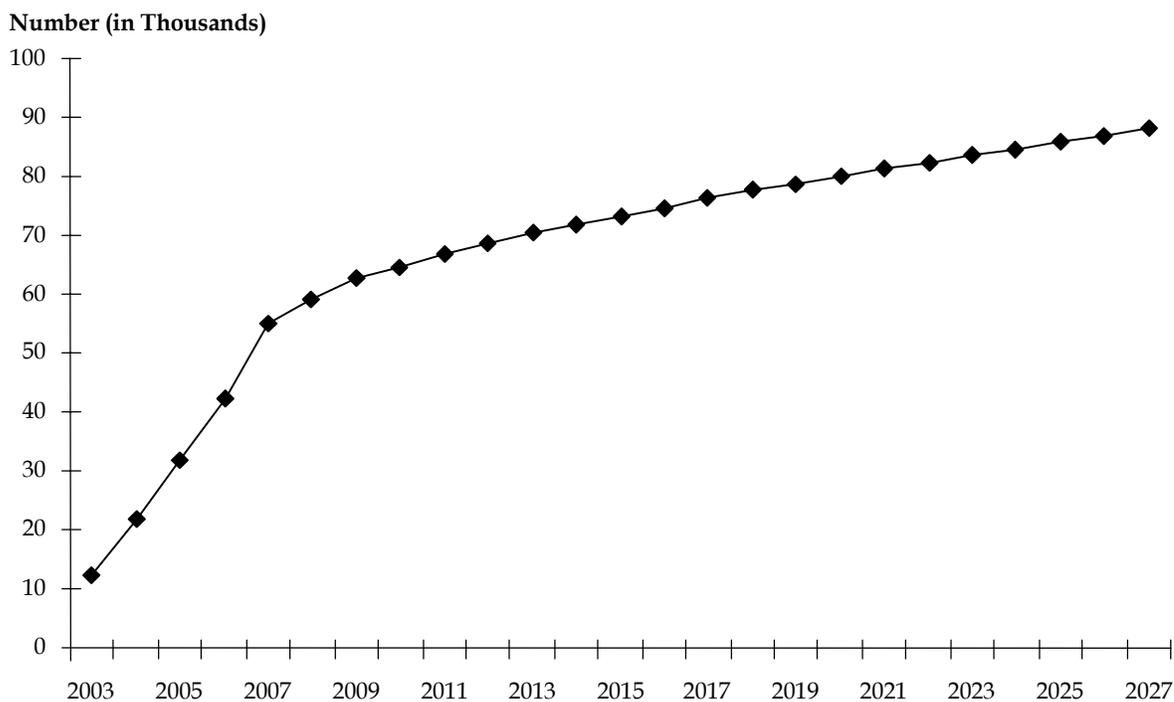
<sup>13</sup>It is estimated that after 2007, direct highway user benefits would continue to grow at the rate of VMT growth from 2003 through 2007. This is a conservative approach consistent with similar analyses.

**Table 4.3 FDOT Work Program Macroeconomic Impacts, 2027**  
*Difference from Control Forecast (in 2002\$, and number of jobs)*

<b>Output (millions)</b>	\$9,160
<b>Personal Income (millions)</b>	\$6,232
<b>Gross State Product (millions)</b>	\$6,326
<b>Employment</b>	87,955
<b>Per Capita Personal Income</b>	\$ 15
<b>Government Transfer Payments (Per Capita)</b>	\$ (24)
<i>Employment in EFI Target Industries</i>	
Communications	796
Electrical Equipment (not including computers)	135
Instruments and related Products	115
Chemicals and related products	138
Transportation (not including motor vehicles)	158
Air Transportation	310

Source: Regional Economic Models, Inc. and Cambridge Systematics, Inc.

**Figure 4.1 Work Program Employment Impact**  
*2003-2027*



Source: Regional Economic Models, Inc. and Cambridge Systematics, Inc.

## Aviation

As mentioned above, an economic impact study of Florida's aviation system was prepared as part of the Florida Aviation System Plan (FASP) 2000. This study sought to analyze the annual economic impact of Florida's aviation system on the regional economy.<sup>14</sup> This study estimates total, direct, and multiplier economic impacts of the Florida airport system.

This study developed economic impact estimates for the 129 civilian public-use airports and the 12 major military air facilities in Florida. Table 4.4 summarizes the results of this analysis for both the public-use airports and military facilities in terms of output, earnings, and jobs.<sup>15</sup>

**Table 4.4 Total Economic Impact of Civil Aviation Airports and Military Air Facilities** (in millions of 2000\$)

	Output	Earnings	Jobs
<b>Civil Aviation Airports (129)</b>	\$50,115	\$12,838	559,395
<b>Military Air Facilities</b>	\$6,245	\$3,575	86,305
<b>Combined Total</b>	\$56,360	\$16,413	645,700

Source: Wilbur Smith Associates, Inc.

The annual economic contribution of Florida's aviation system is indeed significant as it supports 645,700 jobs with an annual payroll topping \$16 billion. Similarly, over \$56 billion in annual economic output can be attributed to the Florida aviation system. According to this report, aviation in Florida accounts for over six percent of the State's gross state product, and when the nation's total aviation-related economic impacts are considered, Florida captures over five percent of the nation's annual aviation-related economic impact activity.

**Other Recent Airport Studies.** Enterprise Florida, Inc. recently conducted an economic development study focusing on regional airports and their role in economic development in Florida.<sup>16</sup> This study sought to establish a clear relationship between air transportation

<sup>14</sup>Technical Summary for the Florida Airports Economic Impact Study. FASP 2000. Prepared by Wilbur Smith Associates, Inc. August, 2000.

<sup>15</sup>Note that the dollar-based economic benefits in Tables 4.4 and 4.5 are not in 2002 dollars, but rather replicate the exact findings from previous studies (in 2000 and 1998 dollars, respectively).

<sup>16</sup>The Impact of Regional Airports on Economic Development in Florida. Enterprise Florida, Inc. Department of Research. January 1999.

and economic development. In order to establish this relationship, interviews with airport and economic developments officials were conducted in addition to examining major industry trends. The ultimate goal of this study was to identify specific issues facing Florida's regional airports, and create parameters for improving region-specific air service and economic development strategies. This analysis includes detailed economic profiles for 13 regional airport market areas in Florida.

This analysis provides a framework for expanding regional aviation service through marketing, creative partnerships and improved infrastructure, and also underscores the relationship between economic development and quality of air service. However, this study does not quantify the transportation system efficiency improvements of incremental investments in Florida's aviation system, which would be necessary for its inclusion in the macroeconomic analysis. Studies of aviation project investments in other states that include estimates of benefit/cost ratios are summarized in Section 5.0.

### *Seaports*

Florida's extensive system of 14 public deepwater ports is an important component of the state's economy and transportation system. With more public deepwater ports than any state in the nation, the port system in Florida is a catalyst for promoting future economic growth in the State including expansion of international trade and tourism.

As referenced in Section 3.0, a recent study for the Florida Ports Financing Commission examined the economic and fiscal impact of Florida's seaports including the impact on jobs, business sales, and earnings within the State.<sup>17</sup> This study was designed to measure the economic impact of existing port operations, capital investments, and international trade activities by various expenditure categories (directly related to the seaports) that were then projected using a statewide economic forecast.

The total economic impact of the port system at the state level is estimated by analyzing the direct, indirect, and induced economic impacts generated by port activity. For example, direct economic impacts include capital and operating expenditures, jobs created by maritime services, consumer purchases by ship passengers and crew, and port construction. Indirect and induced economic impacts (or the multiplier effect) captures business supply and consumer spending related to the initial direct impact of the port system itself. Table 4.5 below details the impact of port operations for output (i.e., business sales), gross state product, earnings, and employment for 1998, 2000, and 2005.

The estimated cumulative effect of Florida's seaports over an eight-year period (1998 to 2005) on output, gross state product, and earnings is \$232.2 billion, \$112.9 billion, and \$69.3 billion respectively. Similarly, an estimated \$9.3 billion in state and local tax revenue is generated by the seaport system over the same period. The net effect on employment is a total of over 465,000 permanent positions attributable to the seaport system in Florida by the year 2005, according to the study.

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<sup>17</sup>*An Analysis of the Economic and Fiscal Impact of Florida's Seaports*, Florida Ports Financing Commission, prepared by MGT of America, Inc. February 1999.

To put this in context, the economic impact of Florida's 14 public deepwater seaports will represent four percent of Florida's gross state product and 6.6 percent of its total employment by 2005. Although not quantified in this analysis, the benefits of Florida's seaport network extend well beyond state boundaries, impacting the economic prosperity of businesses and consumers throughout the country.

**Table 4.5 Overall Economic and Fiscal Impact of Florida's Seaports**  
(in millions of 1998\$)

Measure	1998	2000	2005	Total*
Output	\$22,672	\$25,812	\$36,761	\$232,280
Gross State Product	\$10,919	\$12,475	\$18,010	\$112,860
Earnings	\$6,632	\$7,626	\$11,143	\$69,303
State and Local Tax Revenue	\$836	\$993	\$1,579	\$9,327
Permanent Employment (Jobs)	264,424	307,488	465,846	N/A

\* "Total" is the sum of all years between 1998 and 2005. "Permanent employment" also includes construction jobs, which are recurrent and, therefore, assumed to be permanent.

Source: MGT of America, Inc.

**Other Recent Port Studies.** Florida's international trade volume has been increasing at a rapid pace over the last 10 years, and is a central component of and catalyst for economic growth in the State. A recent study placed the economic value of Florida's international trade at \$63.4 billion in 1997, doubling since 1990. The value of waterborne commerce alone in 1997 surpassed the \$40.9 billion mark, representing almost two-thirds of Florida's total international trade.<sup>18</sup> The Trade Routes study examines more detailed components of Florida's international trade, and develops a list of suggestions to facilitate the continued growth of international trade in Florida.

In another study by the Washington Economics Group, Inc., prospects for future growth in Florida's international trade from 1999 to 2008 are analyzed.<sup>19</sup> According to this analysis, Florida international trade activity reached a record \$69 billion in 1998. Exports were just under \$38 billion, and imports topped \$31 billion. This study presents a forecast of Florida's international trade, based on historical relationships and anticipated economic growth of the global economy, that estimates total trade at \$100 billion by 2003, and \$146 billion by 2008 – a doubling of trade activity in 10 years.

<sup>18</sup>*Trade Routes. A Catalyst for International Economic Development.* Florida Data Center. Florida Ports Council and Enterprise Florida, Inc. By Charles I. Jainarain, Greenheart International, LLC. 1998.

<sup>19</sup>*Florida Trade Outlook: 1999-2008.* Prepared by: Washington Economics Group, Inc., by Robert D. Cruz, Ph.D. Prepared for: The Florida Trade Data Center, March 1999.

In order for these estimates to become reality, Florida's ports must invest in the capital necessary to efficiently handle such trade volumes, and adopt management and marketing strategies that will keep Florida's ports competitive relative to other U.S. ports. Another point made in the study is that trade diversion from Florida to other U.S. states and other North American ports is an impending challenge that should not be ignored.

### *Cruise Industry*

The North American cruise ship industry and its passengers spent \$10 billion on goods and services in the United States during 2001, according to a report commissioned by the International Council of Cruise Lines.<sup>20</sup> Florida's geography combined with the quality of its transportation infrastructure (particularly airports and ports) makes it a natural hub for the cruise ship industry. This analysis identified Florida's share of national cruise ship industry and passenger activity, which as expected, is quite substantial.

On the national level, of the \$10 billion spent on goods and services by the cruise industry and its passengers, Florida received 38 percent of these expenditures for a total of \$4.1 billion. Table 4.6 reviews the total economic impact of the North American Cruise Industry for the United States and Florida.

**Table 4.6 Summary of the Total Economic Impacts of the North American Cruise Industry in 2001**

	United States	Florida	Share of U.S.
Passenger Embarkations (millions)	5.9	4.1	69.5%
Employment	267,762	116,845	43.6%
Wages and Salaries (\$ millions)	\$9,720	\$3,757	38.7%

Source: Business Research and Economic Advisors.

Based on this analysis, it is clear that Florida's economy is a primary beneficiary of spending by the cruise ship industry, and the associated economic activity of cruise ship passengers. In 2001, it is estimated that over 116 thousand jobs with wages and salaries topping \$3.7 billion were attributable to the cruise industry and passenger economic activity in Florida.

Florida's cruise ship industry is a direct beneficiary of maintaining an efficient multimodal transportation network including highways, seaports, and airports. Cruise passengers

<sup>20</sup>*Contribution of the North American Cruise Industry to the U.S. Economy in 2001.* Business Research and Economic Advisors, prepared for the International Council of Cruise Lines. August 2002.

often rely on multiple modes of transportation to reach their destinations, and cruise operators themselves are careful to select ports of call with easily accessible airports and highways. Studies of seaport project investments in other states that include estimates of benefit/cost ratios are summarized in Section 5.0.

### ***Summary of Aviation and Seaport Studies***

There are a few conclusions to draw from this review of existing studies for seaports and aviation. Existing Florida seaports and aviation economic studies have documented the amount of economic activity associated with the state's seaports and airports. However, they do not represent benefit/cost analyses of specific projects or investments.

Nonetheless, the studies clearly demonstrate that ports and airports are key contributors to the state's economy and economic competitiveness. Given the level of economic activity that is supported by these modes, it is reasonable to assume that investments in seaports and aviation facilities that improve service, reliability, and/or capacity for freight, visitor, and business passenger trips will have significant positive macroeconomic benefits. If data, analysis tools, or studies on specific seaport or aviation projects were available to quantify the service improvement impacts for freight, business passengers, and visitors then Work Program investments in these modes could be integrated into the overall analysis. Absent that, it is still clear that these facilities generate significant economic benefits even though the percentage of Work Program investments allocated to these modes is relatively small.

## 5.0 Economic Benefit/Cost Analysis

### ■ 5.1 Highway, Rail and Transit

To more fully account for the benefits of transportation improvements, benefit/cost analyses are increasingly using an economic impact-based approach in addition to the more traditional benefit/cost analysis that relies simply on direct user benefits. The cost side of the analysis is the same for each approach (the costs to build and operate/maintain the system or in this case, Work Program expenditures). However, the benefits for the economic impact-based approach are quite different. Essentially, the real disposable personal income generated by the REMI analysis is used to measure total macroeconomic benefits. Real disposable income is the truest measure of a region's economic well being. It adjusts personal income to account for inflation ("real") and subtracts out federal personal income taxes ("disposable") to capture purchasing power. In addition, personal travel user benefits not captured in the REMI approach are also included. These costs and benefits include the following (also see Table 5.1):

#### Costs

- Work Program investment in highways, transit, and rail from 2002/2003 through 2007/2007 (product investment category) - \$13.6 billion.
- Other costs include product investment support, operations and maintenance, and administration (product support) - \$7.9 billion.

#### Benefits

- Macroeconomic business expansion impacts estimated by REMI and measured by real disposable personal income (includes direct highway business user benefits and related secondary impacts) - \$44.3 billion.
- Direct highway user benefits for personal auto travel - \$74.4 billion.

The economic impacts of construction and operational expenditures (e.g., construction worker wages, etc.) are not included in this analysis (consistent with the economic impact and benefit/cost analysis literature).<sup>21</sup> This is because the construction period benefits are

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<sup>21</sup>Most recently, TCRP Report H-19 provides a good description of this issue and why it is not included in benefit/cost analyses ("Estimating the Benefits and Costs of Public Transit Projects: A Guidebook for Practitioners").

temporary and similarly sized benefits would occur from any spending activity. In addition, it is important to re-emphasize that the benefits to transit and rail users and other social/environmental benefits resulting from these investments also are not captured though estimates of the potential size of these benefits was provided based on other studies. A 25-year time period was used for this analysis – 2003 through 2027. While, there are no absolute rules defining the appropriate analytical period, a 25-year period is long enough to capture the majority of benefits from the Work Program.

Costs and benefits are expressed in constant 2002 dollars and discounted to enable comparability. The present value of costs and benefits that will occur in future years is calculated using a discount rate. Discounting compensates for differences in the timing of costs (which tend to be front-loaded during the construction period), and benefits (which tend to accumulate over time). A cost or benefit is more heavily discounted as it occurs further into the future, with the result that its equivalent present dollar value is reduced. Discounting thus reflects the time value of money – that is, a dollar in hand today has greater value than one received in five years, even after adjusting for inflation, because the dollar in hand now can be invested. Use of the discounted “present value” of future costs and benefits thus provides a consistent basis for comparing costs and benefits accruing at different times in the future. A discount rate of seven percent was used in this analysis, as currently recommended by the U.S. Office of Management and Budget.<sup>22</sup>

Two measures comparing benefits and costs are included:

1. **Net present value (NPV)**, which represents the difference between the discounted stream of future benefits and the discounted stream of future costs; and
2. **Benefit/cost ratio (B/C)**, which represents the discounted stream of future benefits divided by the discounted stream of future costs.

Table 5.1 displays the results of the economic benefit/cost analysis for the FDOT Work Program, representing investment in highways, transit, and rail. The table displays a benefit/cost ratio, and the individual components of the analysis.

A benefit/cost ratio above 1.0 indicates that benefits exceed cost, and represents the lowest value that should be considered for a transportation investment if no other non-monetary factors are to be considered, and if there is no uncertainty in the analysis. These conditions never exist in reality.

In the case of the FDOT Work Program, the benefit/cost ratio of 5.5 indicates that for every \$1.00 of Work Program investment a return (benefit) of \$5.50 can be expected. These results should be interpreted carefully and within the context of this analysis. The benefits of FDOT Work Program investment shown here represent the benefit of spending \$21.5 billion over five years on the Florida transportation system versus doing nothing and letting the system deteriorate over that time. The 5.5 benefit/cost ratio is clearly very positive, and does fall within a range seen in other studies nationally. Individual project investments will have widely varying B/C ratios and since this analysis covers an entire

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<sup>22</sup>The seven percent discount rate is consistent with guidelines put forth by the Office of Management and Budget in Circular No. A-94 ([www.whitehouse.gov/OMB](http://www.whitehouse.gov/OMB)).

program of investments rather than an investment at the margin of a host of other investments, a relatively large B/C ratio is not surprising.

**Table 5.1 Economic Benefit/Cost Analysis of FDOT Work Program**  
(billions of 2002\$, cumulative change, 2003-2027)

<b>Benefits</b>	
PV Disposable Personal Income	\$44.3
PV Non-Business Auto	\$74.4
<b>Total Discounted Benefits</b>	<b>\$118.7</b>
<b>Costs</b>	
PV of Product Investments	\$13.6
PV of Remaining Work Program Investments	\$7.9
<b>Total Discounted Costs</b>	<b>\$21.5</b>
NPV (Benefits Minus Costs)	\$97.2
<b>B/C Ratio (Discounted Benefits/Discounted Costs)</b>	<b>5.5</b>

Source: Cambridge Systematics, Inc.

### *Sensitivity Analysis*

It is important to understand that there is uncertainty reflected in any benefit/cost analysis. Costs and benefits can change, and the choice of discount rate can have a significant impact on the analysis outcome. Tests were conducted to evaluate the sensitivity of the benefit/cost analysis results. The purpose of these tests is to evaluate the effect changes in certain key assumptions may have on the benefit/cost analysis of the Work Program evaluated in this study. Three tests were performed:

- **Discount Rate.** A discount rate of seven percent was used in this analysis, as currently recommended by the U.S. Office of Management and Budget. The discount rate puts future costs and benefits in “present value” terms thus providing a consistent basis for comparing costs and benefits accruing at different times in the future. With a five percent discount rate (a more aggressive assumption), the benefit/cost ratio is 6.6 while a nine percent discount rate results in a B/C ratio of 4.7. In either case, Work Program investments would yield substantial benefits.
- **Business Auto Benefits.** For purposes of the economic impact analysis, benefits to auto trips are split into business and non-business trips. It is important to note that business auto trips (“on-the-clock”) do not include commuting trips. Based on data from the Nationwide Personal Transportation Survey (NPTS), 11.9 percent of total auto trips are considered to be on-the-clock auto business trips.<sup>23</sup> However, it is possible

<sup>23</sup>Bureau of Transportation Statistics, National Personal Transportation Survey. [www.bts.gov/ntda/npts/desc.html](http://www.bts.gov/ntda/npts/desc.html).

that the share of business auto trips in Florida differs from the national average. If the share were 15 percent (a more aggressive assumption), the benefit/cost ratio increases to 5.7 while a share of nine percent yields a reduced B/C ratio of 5.3. Both values are very similar to the 5.5 ratio resulting from this study.

- **Traffic Growth.** Estimates of future average annual daily traffic (AADT) were made in conjunction with the FDOT Transportation Statistics Office. Different estimates of future traffic growth on Florida's roadways could produce higher or lower benefits. If future AADT were 15 percent lower than our forecast, the benefit/cost ratio in this analysis would be 5.4. Conversely, if future AADT were 15 percent higher than our estimates, the B/C ratio would rise to 5.7. Again, both values are very close to 5.5.

These tests indicate that the use of alternative assumptions including the discount rate, share of business auto trips, and future AADT does not significantly change the main findings of this analysis. Although sensitivity testing helps to eliminate some of the inherent uncertainty involved in all benefit/cost analyses, economic and demographic conditions could still change over time and affect the results of this analysis. However, there is no question that over a wide range of reasonable assumptions the FDOT Work Program generates significant benefits to the State.

## ■ 5.2 Seaport and Airport

### Benefit/Cost Analysis of Seaport and Airport Expansion Projects

Several studies have examined the economic benefits and costs of specific seaport and airport *capacity expansion* projects. These studies serve as an example of the range of benefit/cost ratios that project-specific airport and seaport capacity expansion projects could have in Florida.

**Seaports.** The economic impact (benefit/cost ratio) of increasing port capacity through channel deepening and widening is illustrated in the following three studies:

- The Port of Corpus Christi recently completed a study examining the benefit of both widening and deepening (from 45 to 50 feet) the Corpus Christi Ship Channel serving the port. The benefits of this project were based on reduced transportation costs calculated using vessel class and commodity-specific analysis. Benefit/cost ratios of the preferred alternative range from 2.87 to 3.79.
- The Oakland Harbor Navigation Improvement Project examined the potential benefits resulting from deepening the Oakland Harbor and entrance channels from 45 to 50 feet. Benefit/cost ratios of the preferred alternative range from 12.07 to 13.05.
- The New York and New Jersey Harbor Navigation Project recommends deepening several channels including the Ambrose Channel, Anchorage Channel, and Kill van Kull channel. The reported benefit/cost ratio of this project is 1.6, which includes an estimated initial cost of over \$1.7 billion.

These studies all involve widening and/or deepening port access channels to reduce transportation costs and shore-side operating costs associated with tidal delays. The benefit/cost ratios of these port access and capacity improvement projects range from 1.6 to 13.05. There are no readily available studies that estimate the economic benefit of port security improvements, which are the focus of current Work Program port investments.

**Airports.** The set of major capital investments for all 129 public use airports designated in the Florida Airport System Plan (FASP) can mostly be identified as either capacity or safety improvement projects. Specific projects that increase airport capacity can generate improved travel time, increase cost savings, and improve business productivity through more efficient cargo movement. However, there is no reliable basis for valuing the benefits of safety projects in dollar terms. That is because the incidence of deaths and injuries from aircraft crashes is extremely rare, and the financial consequences can be extremely large with a high degree of variance.

The following are examples of studies that assess the benefit of airport expansion relative to costs:

- A recent study examined a new airport (runway and terminal) in Western West Virginia with a capital cost of \$278 million. The B/C ratio of this project is 1.38.
- Another recent study looked at Baltimore Airport's plans to expand terminal facilities and gates to accommodate a new air carrier (Southwest Airlines). It calculated the project capital cost (\$34.8 million) and defined benefits in terms of gate holding time, taxiway time and reduced tow operations cost. This analysis yielded a B/C ratio of 2.7.
- A study for an all-cargo airport in Wisconsin looked at the benefit of adding a new runway to handle larger aircraft. This study calculated project capital costs (\$10 million), as well as the operating cost and annual benefit. Annual benefits included travel time and travel cost savings, as well as the added savings in productivity for area manufacturers. This analysis reported a B/C ratio of 5.27.

These three projects analyze the potential benefit of airport expansion through building a new runway and/or terminal. The B/C ratios of these three projects range from 1.38 to 5.27. Again, there are no readily available studies that examine the economic benefit of airport safety or security improvements, which are the focus of current Work Program aviation investments.

Based on these studies and through knowledge of the FDOT Work Program, it is reasonable to conclude the following:

- A small sample of airport investment projects that expand capacity (i.e., a new runway or passenger terminal) have B/C ratios ranging from 1.38 to 5.27. Similarly, seaport investment projects that improve port access and expand capacity (i.e., channel deepening and widening) have B/C ratios ranging from 1.6 to 13.05.
- Florida DOT Work Program investments generally supplement a wide range of investments by airports and seaports including security improvements, equipment purchases, and infrastructure rehabilitation.

From the literature of benefit/cost studies of seaport and airport expansion projects and the existing economic contribution of seaports and airports to the Florida economy, it is clear that these modal facilities play a very important role in the productivity and size of the Florida economy. Further, it is likely that major expansions and investments in these modes would generate significant B/C ratios similar to those found for seaport and airport *capacity expansion* projects in other states. However, given the range of investments supported by the Work Program (i.e., equipment purchases, security, etc.), it is difficult to *quantify* the economic impacts of program level (rather than project-specific) airport and seaport Work Program investments, that are different in nature from major expansion projects.

# Appendix A – Florida Statutes

## Title XXVI, Public Transportation

### Chapter 334, Transportation Administration

#### 334.046 Department mission, goals, and objectives.

- (1) The prevailing principles to be considered in planning and developing an integrated, balanced statewide transportation system are: preserving the existing transportation infrastructure; enhancing Florida's economic competitiveness; and improving travel choices to ensure mobility.
- (2) The mission of the Department of Transportation shall be to provide a safe statewide transportation system that ensures the mobility of people and goods, enhances economic prosperity, and preserves the quality of our environment and communities.
- (3) The department shall document in the Florida Transportation Plan, in accordance with s. 339.155 and based upon the prevailing principles of preserving the existing transportation infrastructure, enhancing Florida's economic competitiveness, and improving travel choices to ensure mobility, the goals and objectives that provide statewide policy guidance for accomplishing the department's mission.
- (4) At a minimum, the department's goals shall address the following prevailing principles.
  - (a) *Preservation* – Protecting the state's transportation infrastructure investment. Preservation includes:
    1. Ensuring that 80 percent of the pavement on the State Highway System meets department standards;
    2. Ensuring that 90 percent of department-maintained bridges meet department standards; and
    3. Ensuring that the department achieves 100 percent of the acceptable maintenance standard on the state highway system.
  - (b) *Economic competitiveness*. – Ensuring that the state has a clear understanding of the economic consequences of transportation investments, and how such investments affect the state's economic competitiveness. The department must develop a macroeconomic analysis of the linkages between transportation investment and economic performance, as well as a method to quantifiably measure the economic benefits of the district-work-program investments. Such an analysis must analyze:

1. The state's and district's economic performance relative to the competition.
  2. The business environment as viewed from the perspective of companies evaluating the state as a place in which to do business.
  3. The state's capacity to sustain long-term growth.
- (c) *Mobility* – Ensuring a cost-effective, statewide, interconnected transportation system.

## Chapter 339, Transportation Finance and Planning

### 339.137 Transportation Outreach Program (TOP)<sup>24</sup>

- (1) There is created within the Department of Transportation, a Transportation Outreach Program (TOP) dedicated to funding transportation projects of a high priority based on the prevailing principles of preserving the existing transportation infrastructure; enhancing Florida's economic growth and competitiveness; and improving travel choices to ensure mobility.
  - (2) For purposes of this section, words and phrases shall have the following meanings:
    - (a) *Preservation* – Protecting the state's transportation infrastructure investment. Preservation includes:
      1. Ensuring that 80 percent of the pavement on the State Highway System meets department standards;
      2. Ensuring that 90 percent of department-maintained bridges meet department standards;
- 
- (8) Because transportation investment plays a key role in economic development, the council and the department shall actively participate in state and local economic development programs, including:
    - (a) Working in partnership with other state and local agencies in business recruitment, expansion, and retention activities to ensure early transportation input into these activities.
    - (b) Providing expertise and rapid response in analyzing the transportation needs of emergent economic development projects.
    - (c) The council and department must develop a macroeconomic analysis of the linkages between transportation investment and economic performance, as well as a method to quantifiably measure the economic benefits of the investments.

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<sup>24</sup>Only parts (1), (2), and (8) of this section are included in the Appendix.



*Published by  
The Florida Department of Transportation  
Office of Policy Planning*

*[www11.myflorida.com/planning](http://www11.myflorida.com/planning)*

*February 2003*